RIBES ERADICATION MANUAL

FOR

BLISTER RUST CONTROL IN CALIFORNIA

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I. Introduction

White pine blister rust is a parasitic fungous disease of white and sugar pines. In order for the disease to exist and spread, it must spend a part of its life cycle on Ribes (currants and gooseberries). Infection cannot spread directly from one pine to another. The elimination of the Ribes in a white-pine stand destroys the alternate host essential to the rust's existence and automatically prevents further infection of pines. There are two important phases in the rather complicated life history of this disease that are of fundamental importance in control work: (1) the Ribes-infecting spores from the pines are capable of spreading infection great distances to Ribes (in excess of 150 miles), and (2) the pine-infecting spores from the Ribes can only spread infection to pines for relatively short distances (approximately 1,000 feet under conditions existing in the sugar pine region). Thus, although infection can be introduced from distant infection centers, it is possible to effectively control the disease on any selected area by the eradication of Ribes on the control area and from a strip 1,000 feet wide immediately surrounding it to prevent infection on Ribes outside the control area from reaching pines within. White pine blister rust can be controlled only through the eradication of Ribes from the areas selected for protection.

II. Purpose of Manual

The objective of this manual is to describe the present approved methods of Ribes eradication in California and to prescribe general principles to guide those supervising control operations. No detail of description can be sufficiently comprehensive to cover the many special problems arising in the field, however, and field supervisors must exercise individual initiative and judgment in meeting these problems.

III. Standards of Control

A. Relation of eradication costs to control.

The ultimate goal of Ribes eradication is the permanent extermination of all Ribes from control areas in order to protect the sugar pine on such areas from damage by white pine blister rust. To reach this goal, the control operation must first remove the original bushes growing on the area, and must cover areas favorable to Ribes growth again at subsequent suitable periods until new bushes have stopped appearing. When an area is placed in this Ribes-free condition, blister rust control has been established and thereafter the area is said to be on a maintenance basis.

However, when Ribes occur in their natural condition over large areas of forest land, it is found that their occurrence and distribution are determined by reasonably definite factors and that the only sort of control program which can be successful must be based upon a knowledge of these facts. A logical program of Ribes eradication must recognize the fundamental

facts that Ribes are plant species which appear in the early stages of ecological succession following denudation of forested areas, that their persistence and reproduction are favored by the conditions represented by the early stages of such ecological succession, that they are able to persist as a component part of the flora of such forested areas only when the forest stand which follows denudation is relatively thin and that the only uniform exception to these conditions prevails along streams where conditions for growth, persistence and reproduction of Ribes are more or less continuously favorable. This means that some forest areas are now in that part of their rotation which offers unfavorable conditions to Ribes growth and regeneration and that one thorough eradication job will result in the permanent suppression of Ribes; while on other areas which now offer favorable conditions for Ribes growth, several workings will be necessary to reach the desired goal. The control plan must consider the status of Ribes development on an area, in order that the standards of work applied shall maintain a proper balance between costs (especially the initial working) and results accomplished. Since results are largely measured by the permanency of Ribes-free condition established, working methods which involve excessive searching for small bushes in areas favorable to continued Ribes development and working methods which do not involve a thorough working for areas unfavorable to continued Ribes development, result in a cost out of proportion to the protection obtained.

In setting up the control standards that follow, it was first necessary to broadly recognize two general stages in the development of the Ribes flora, namely: (1) Ribes population that is on the increase, and (2) Ribes population that has passed the peak in its development and is either only holding its own in competition with other forest plants or is being suppressed by them.

1. Ribes population on the increase. Disturbances to forest and ground caused by logging and fire set up conditions favorable to Ribes growth, and the seeds of many seasons which have been stored in the duff soon germinate and produce new plants. Ribes seeds exhibit a remarkable ability to remain viable in the forest floor over long periods, and to germinate and form new bushes when environmental conditions are favorable. These bushes grow rapidly and fruit abundantly and new bushes continue to increase until the timber stand closes and curtails their development. Also along stream bottoms conditions for the growth, persistence and reproduction of Ribes are usually favorable. Under those conditions, all Ribes might be removed one season and many new ones would appear within a few years. Several follow-up jobs are necessary and the objective of the initial eradication is to remove all large bushes in order to prevent the production of additional seeds.

2. Ribes population on the decline. On most virgin-timbered areas where the forest canopy is generally unbroken, the competition of the cover type, accumulation of forest litter and changes in light and moisture incident thereto, represent growing conditions unfavorable to Ribes. Where Ribes are present, they originated during the younger and more open stages of the ground cover which preceded this unfavorable condition. In such situations, they are barely able to maintain their position in the stand and under some conditions are even slowly being suppressed. Bushes in this classification grow but slightly from year to year and bear but a scanty

fruit crop, if any, in contrast with the fast-growing, prolificly fruiting plants in logged areas. Practically no seedlings are produced under these conditions, and when a thorough initial eradication job is done, the Ribes-free condition thus set up will continue over a long period.

B. Ribes live-stem standards. In order to attain an eradication cost consistent with the final objective of the work, the above facts must be taken into account, and around them, and in accordance with pathological studies on blister-rust damage, the following Ribes-live-stem standards were evolved.

1. Areas that may need only one working. For all areas on which the initial eradication represents the only general eradication necessary to establish a Ribes-free condition that will remain unchanged for an extended period (Ribes population on the decline) the Ribes must be reduced to an amount not to exceed an average of 25 feet of live stem per acre. Pathological studies of white pine blister rust have shown that the eradication of Ribes to 25 feet of live stem per acre is sufficient to establish initial control. In the application of this 25-ft. limitation, it is essential to examine the distribution of missed Ribes on the checking maps in order to make certain no bad concentrations of live stem remain on any area, for it is possible to have an average well within the 25-ft. limits and still have restricted areas supporting an excessive amount of live stem. Areas not conforming to this standard must be reworked until they do. As a general working rule any area of 20 acres or more in size must conform to the 25 feet of live stem per acre standard.

Under the above classification occur all virgin-timbered areas, old logged areas in which the cover again resembles that of the virgin forest, and brush fields in which the predominating brush species are manzanita and/or chinquapin.

2. Areas that will need more than one working. For all areas requiring more than one eradication in order to secure permanent Ribes suppression, the 25-ft. rule will apply only to bushes measuring 3 feet of live stem or more.

Under this classification occur most logged areas and burns, brush types in which the predominating brush species is neither manzanita nor chinquapin, and all stream type.

In such areas the plan of work should be directed toward the removal of all large bushes and as many of those measuring less than 3 feet of live stem as is compatible with a reasonable cost. In other words, the crewman should pull these small bushes whenever he sees them but he should not intensively cover every foot of ground in order to find them.

IV. Eradication Types and Ribes Species

Within any sugar pine area there exist certain definite factors governing plant growth (light, heat, moisture, soil, etc.) which determine

the species of Ribes present, the number of bushes per acre, and the physical condition of those present or likely to appear in the future. These conditions, in turn, determine the best methods and technique to use in Ribes eradication, the interval between initial and subsequent workings and the number of such workings needed to suppress the Ribes permanently.

A. Eradication types.

To facilitate the planning and execution of the blister-rust-control program, these influencing factors have been broadly classified according to their relation and bearing upon the work. The ensuing classifications represent only the major distinctions found in the forest and are designated as eradication types. The five eradication types used in California arranged in general decreasing order of Ribes abundance are as follow:

1. R. inerme swamp type. On the more or less swampy ground bordering sluggish streams, generally in or adjoining meadowlands, occur dense masses of Ribes inerme intertwined so closely with thickets of willow and other species of brush that the associated brush species must be eradicated along with the Ribes. This is a relatively infrequent type occurring from the Tahoe Forest northward and requires special eradication methods.

2. Stream type. This type consists of a narrow belt of land along streams, draws and swamps varying in width with the topography, along which occur concentrations of Ribes in association with willows, alders and annual plants.

3. Timber cut-over type. All lands which have been logged fall into this type except (1) those lands on which logging was done so long ago that a timber stand again occupies the ground and the favorable Ribes conditions set up by logging have reverted to those prevailing in the virgin forest and (2) old logging areas on which no timber reproduction is recurring and on which occur, instead, fields of brush. The first of these exceptions should be classified as timber type and the second as brush type. Cut-over type is characterized by abundant Ribes, debris and brush.

4. Brush type. All areas where the ground is partially or completely covered by brush, with trees or reproduction entirely absent or too sparsely present to revert to timber type for many years to come, are classified as brush type. Ribes are moderately abundant and usually increase in numbers toward the margin of the type where the brush is less dense.

5. Timber type. This is the most common type and is represented by all virgin-timbered areas or very old cut-over areas on which the timber cover and Ribes distribution again resemble those of the undisturbed forest. The distribution of Ribes and brush varies considerably, depending upon exposure and density of the timber stand.

Areas that have been burned should be classified under one of the above types most accurately depicting the conditions on the burn. For example, an area on which a light ground fire had occurred killing no large trees and resulting in no heavy influx of Ribes would be classified as timber type. A burned area on which the timber cover was generally killed would be classified under cut-over type if any living trees were present, and as brush type if all trees were destroyed and brush was taking over the area. In these latter two instances Ribes are present in moderate to dense concentrations.

B. Ribes species and their distribution.

Ribes prefer cool, moist situations and generally occur in greater abundance on the north and east exposures under the sugar pine-fir types (true firs, Douglas fir, or both) than on south and east exposures where ponderosa pine is the common associate of sugar pine and where the site is drier and less favorable for Ribes growth. Logged or burned areas support more Ribes than virgin areas on corresponding exposures.

The most common Ribes species throughout the sugar-pine region is the prickly-fruited gooseberry (Ribes roezli). This plant occurs in various amounts in almost all sites from the hot, dry south slopes to the cool, moist slopes adjacent to streams, and from the lower altitudinal limits of sugar pine to the upper. It is most abundant, however, on moist, well-drained slopes and is particularly prolific on logged areas and burns.

Next in abundance is the Sierra Nevada currant (R. nevadense). This species is more or less restricted to stream type and moist slopes adjoining streams, springs and swamps.

In the northern Sierra Nevadas, restricted to marshy bottom lands in or adjoining meadows, is found the white-stemmed gooseberry (R. inerme). This species occurs in great profusion intermingled in dense thickets of willow and other brush.

At high elevations, chiefly in sugar pine-fir timber types, are found the squaw currant (R. cereum) and the sticky currant (R. viscosissimum). These two currants occur normally in great abundance in the fir belt just above the altitudinal range of sugar pine and only occasionally do they inhabit the sugar-pine type other than for a few scattered individuals. However, when patches of these Ribes are encountered, particularly the squaw currant, they present a most difficult eradication problem frequently necessitating special eradication methods.

A detailed description of these Ribes will be found in the appendix.

V. Organization and Planning of Work.

A. General Blister-Rust supervisory staff.

1. Operation supervisor. The Blister-Rust operation supervisor is in direct charge of the technical phases of the blister rust control activities on the forest. He locates working area boundaries, outlines the

general plan of work to be followed, assists in locating, establishing, and moving camps, organizes field operations so as to secure maximum efficiency and gives general supervision to all eradication work. He works in close contact with the Forest Supervisor.

2. Unit supervisor. A unit supervisor is an assistant of the operation supervisor and is delegated the responsibility of direct supervision over the work of a group of camps so located and of such number as to permit regular and frequent inspections. It is his duty to be thoroughly acquainted with all phases of the work in each camp under his technical direction and to study the work of each camp in order to maintain maximum productiveness and efficiency. Analysis and interpretation of checking data and any rework arising therefrom will be made and directed by the unit supervisor in collaboration with the camp foreman.

Except on rare occasions, all instructions from the operation supervisor will be transmitted to camps through the unit supervisor.

3. Checking forces. A checking foreman and a number of checkers, under the jurisdiction of a general checking supervisor will be located in the Blister-Rust camps for the purpose of systematically checking the treated areas to see that the eradication work conforms to the established control standards. The checking organization is essentially a service organization whose job is to appraise Ribes conditions on the ground after eradication. From this appraisal come recommendations as to the amount of additional work, if any, needed to meet the prescribed Ribes live-stem requirements.

Checking and eradication are interrelated parts of the control operation and each should work in close harmony with the other in order to insure an effective control job.

B. Duties of camp foremen and straw bosses.

1. Eradication duties. Each Blister Rust camp is under the direct supervision of a camp foreman. In camps of thirty men or more the foreman will have one or more straw bosses to assist him in supervising the field work. The camp foreman, working under instructions from his unit supervisor, is responsible for the proper performance of control activities on his camp area and for the efficient management of the camp itself. It is his duty to see that all records and maps are properly kept up to date, that tools and equipment are kept in first class condition and properly accounted for and to discharge employees for inefficiency and infractions of rules.

Just as soon as the eradication work on a block is completed and the camp foreman is satisfied that it is ready for checking, he notifies the checker located in his camp of the location and description of the area to be checked and the approximate time he would like to have the checking work completed. The checker will then check the area according to methods outlined in the checking manual and upon completion of the check, furnish the camp foreman with the summarized results.

Duties of the straw boss are those delegated him by the camp foreman. The field work of straw bosses is to supervise a number of eradication crews, and other eradication work as directed by the foreman. Camp foremen and straw bosses are expected to spend the majority of their time actually directing the field operation. Only office work of the most urgent kind will be accepted as an excuse to remain in camp longer than one hour during the regular field day.

Camp foremen and straw bosses should watch the progress of crew work from day to day and study their men, especially crew leaders. Frequent conferences with crew leaders on such subjects as speed of crews, width of crew strip, cooperation among crewmen in digging Ribes, plans for traversing work units for different forest conditions and problems of a similar nature will reveal ways of increasing the output of work with a normal expenditure of energy.

Ribes distribution and working conditions vary considerably in different forest types and men can work to best advantage when they are acquainted with these conditions. Not only should the camp foreman be thoroughly familiar with working conditions in his area but he should also train his men to recognize them and to know the best procedure to follow in all cases.

2. Forest fire duty. The district ranger or his designated dispatcher is authorized to call any or all crews for fire duty at any time. These calls must be responded to with the utmost dispatch. In case a fire starts within or near the camp area, the foreman should not wait for a formal request but should take immediate action and get men on the fire and do his best to control it until relieved by regular fire crews.

The forest supervisor will consider the Blister Rust camp personnel as a part of his emergency fire suppression organization and acquaint the camp foreman with regulations governing fire duties in this connection. During especially hazardous periods a part or all of the camp personnel may be held in camp over week-ends for emergency fire duty and all men should be acquainted of this possibility. A fire-fighting tool cache will probably be established in each camp. Such tools should be for fire use only and should not be disturbed or used for any other purpose. It is mandatory that all men rigidly adhere to all fire laws and forest regulations at all times.

3. Suggested regulations on camp management. In order to have the work progress smoothly in the field, it is essential that the camps be conducted in an efficient manner. The following points will assist the foreman in maintaining proper order in his camp:

a. Definite schedules.- A definite schedule for meals and work should be set up and maintained.

b. Discipline.- A just and systematic discipline must be established and maintained in each camp. The camp foreman should post a set of camp regulations that he considers necessary and see that these regulations are enforced. Offenders of the camp rules should be dealt with promptly and if necessary dismissed.

c. Inspection of kitchen.- The kitchen should be inspected periodically to see if it is clean, if the food is being properly cooked and served, if any food is wasted, if any supplies are being taken from the supply tent that are not being used in the kitchen, if there is harmony among the kitchen staff, if dishes are being properly sterilized, if too much food is on hand, and in general, if the kitchen is being managed properly. A list of regulations outlining necessary measures to be followed by the cooking staff appears in the appendix. A copy of these regulations should be conspicuously posted in the cook and mess house and there adherence insisted upon. The camp foreman should approve all regulations for supplies.

d. Inspection of grounds and tents.- The camp grounds including garbage pit and latrines should be inspected frequently to see if they are being taken care of properly. Men's tents should be inspected regularly to see if they are being kept clean and orderly. The camp should be kept sanitary. Slop holes, garbage pits and latrines should be kept flyproof and regularly disinfected.

e. Handling of equipment.- The men should be charged out with a pick and canteen apiece. Tent representatives should be issued a lantern, wash basin, stove and bucket. Tools should be loaned to the men with the understanding that they are to be returned as soon as the man is through with them. Have a simple system of handling equipment that is to be used by the men.

f. Camp detail.- It is usually best to clean up the camp as soon as it is established. Put a fire line around the camp area and see that it is kept free of debris during the entire season. Get enough wood at the first of the season to do several weeks so that a man doesn't have to be detailed every few days for this purpose.

g. Personnel meetings.- When the camp opens, a general meeting of all the men should be held when the purpose and method of doing the work will be explained. At this meeting the camp regulations should be presented and discussed. It is well to hold crew-leader meetings occasionally to discuss general topics of field importance and at the close of these, discuss problems concerning the management of camp.

h. Construction of camp.- The mess hall and kitchen will be constructed according to approved plans but the general location and plan of camp will be left more or less to the camp foreman. The men's tents should be in a row if possible facing a common company street.
If the camp site space permits, there should be a distance of at least 10 feet between tents as a fire precaution. The inventory should be taken of

equipment as it arrives so that no item will be overlooked.

i. Breaking camp.- The camp foreman should direct the work of dismantling the camp. His inventory should be checked item by item as the packing proceeds. Instruction for packing equipment will be issued during the latter part of the season.

j. Clerical work.- Clerical work should be done promptly at the end of each day's work. A business-like attitude taken by the camp foreman in the office will spread and be absorbed by the men.

k. Reporting injury.- All injuries received on the job should be reported immediately to the camp foreman. An injury needing more than first-aid attention should be taken to the authorized doctor for care. Instructions regarding compensation forms for injury will be issued at training camp or by the Forest Service.

l. Leaving camp over week-ends.- Any man leaving camp over the week-end must report to the camp foreman before leaving. When fire season opens, it is probable that men will be held in every other week-end. The cook should know in advance the number of men expecting to be away so that he can prepare the proper amount of food.

The duties of camp foremen bearing upon camp management are applicable to regular Blister Rust camps only.

In some cases blister-rust work may be one of several forest activities conducted from one large camp. Such camps will have a general superintendent whose duty is to handle all matters pertaining to camp management and in this event the responsibility of the Blister Rust foreman is limited to the technical direction of field work of the men engaged upon blister rust control. Special regulations and instructions will be issued to Blister Rust foremen in mixed activity camps relating to their special duties in such camps.

C. Planning the work.

For effective administration of the eradication job, it is essential that the foreman have a complete working knowledge of his camp area and the problems it presents in advance of the actual eradication work. This knowledge can only be gained by a thorough personal inspection of the area. To assist him in this preliminary examination, the camp foreman is provided with a map of the area scheduled to be worked from his camp. This map represents the most reliable information available, and in addition to indicating the important cultural features, shows, for all sections on which Ribes reconnaissance has been done, the general distribution of Ribes on each section. However, most existing maps of mountainous areas are not sufficiently accurate for recording the permanent eradication records and this work map will be replaced by a more detailed one during the progress of the work. Methods of preparing the final eradication map are described on page 16.

With his work map to guide him, the foreman should first cover his area in order to familiarize himself with the general lay of the land

giving particular attention to the location of camp area boundaries, all roads and trails, important topographical features, general working conditions and Ribes distribution. The information gained from this inspection tour will serve as the basis for selecting the sections on which to commence eradication work. Areas outlined for early season work should preferably be ones supporting a rather numerous and uniform distribution of Ribes. Inexperienced crews can more readily be trained in such areas. Also, by starting crews in areas of abundant Ribes, the foreman will be better able to properly plan his attack for the remainder of the area, which will more than likely involve the elimination of certain areas from crew work because of their natural Ribes-free condition. In so far as possible, inexperienced crews should not be assigned to areas of few Ribes.

D. Advance checking.

As a result of the preliminary survey by the camp foreman and straw boss, certain areas will appear to run very light in Ribes. Before any crew work is attempted in such areas they should be advance-checked by the checking organization in accordance with standard advance checking methods as outlined in the checking manual to determine whether any crew work is necessary. All advance checking will be performed by the checkers and the camp foreman should designate to the checker headquartered at his camp any area of over 20 acres appearing low enough in Ribes to warrant an advance check. Care should be taken not to solicit an advance check on areas where it is obvious crew work will be needed, for the sole purpose of the advance check is to measure accurately the Ribes distribution to determine whether or not an area containing few Ribes can be eliminated from crew work. Checkers are instructed to terminate an advance check when it is obvious that none of the area can be eliminated from crew work. When an advance check has been completed, the checker will turn the information over to the camp foreman and with this information on Ribes occurrence, the foreman can properly block out Ribes-free areas. The duty of the checker in this connection is to present the foreman with the facts regarding Ribes distribution and it is the responsibility of the camp foreman to decide what areas are to be worked by crews and what areas are to be blocked out and to superintend such work.

VI. Methods of Work

There are three general methods of Ribes eradication in use in the West, namely, hand, chemical, and mechanical. Of these, hand eradication is the only one that has been used to any extent in California, and this manual will confine its descriptions to hand eradication methods.

A. Laying out areas.

1. The section. The section (one square mile) is the basic unit used in conducting all eradication work. All data will be recorded by eradication types for each section or fractional section within the camp area.

2. The block. The section is usually too large a unit in which to effectively handle crews and it is customarily divided into smaller units called blocks. These blocks are primarily administrative units and may be any size conducive to the proper handling of crews under a given set of working conditions. String is used to delimit the blocks into regular subdivisions of the section (or such subdivisions as 160, 80, or 40-acre blocks, depending upon the needs of the occasion). In cases where a natural boundary would more or less parallel the string line, it may be used instead of laying a string. With the exception of quarter lines, string delimiting blocks should be in white.

3. Delimiting sections and blocks. A red string line should be run around all sections in order to clearly delimit the section boundary. This line should be placed high enough to prevent its being broken or pulled out by cattle or deer and tied to trees and other supports at frequent intervals in order to prevent a general loss of guide line in case of breakage. Red string is also used when a section is divided into quarters. Quarter lines should be laid out the same way as section lines.

B. Working procedure for a block.

1. Systematic working of a block. Lay the plans for working a block systematically so that when more than one crew is assigned to a block, each may have a sector for which it is responsible. The more that crews are concentrated in adjacent blocks, the more easily can they be supervised; however, blocks should represent from one to two weeks' work for a crew. When the block is nearing completion, be sure that only one crew is left for the last day's work as excessive moving of crews within or between blocks during working hours not only causes confusion but wastes time. When an area is completed, the crew should have definite instructions as to the location of their next block or the camp foreman or straw boss should be present to supervise the movement of the crew.

Whenever it is possible, the work within a block should be so planned that crews can reach fresh drinking water at least once or twice daily.

Travel time should be kept to a minimum by starting crews at the more accessible end of a block. Build man-ways in to the inaccessible areas if crews are going to be working there any length of time.

Plan the work so that areas of difficult working conditions may be assigned equitably among crews.

2. Direction of strips. All strips within a quarter section should be run in one direction. With this in mind, determine the direction that will give the greatest number of strips running up hill and down hill as this procedure has proved to be more efficient than working along the contour.

3. Speed of work. Areas where Ribes are numerous and of various sizes should be worked very rapidly with the idea of keeping the men digging thus eliminating searching time. This system will probably necessitate

working a part of the area a second time, but since rework is done rapidly with a one-man rework crew, much time will be saved. The normal amount of rework should be between 15 and 25 percent of the area containing numerous Ribes. When working brush type and areas of few Ribes, plan on progressing as rapidly as possible and still obtain the desired Ribes-live-stem standard in one working. Time is wasted if rework is necessary for these cases.

4. Crew formation. The standard eradication crew consists of three men, one of whom is designated as crew leader. A 3-man crew has proved to be the unit that can most effectively conduct Ribes eradication on a given block. The crewmen work in echelon formation guiding on the foremost flank man. In no case is the rear flank man more than a few yards behind the leader. Spacing between men varies from 12 to 60 feet, depending upon the general working conditions and the number of Ribes encountered. Where the intervals are wide, the men weave back and forth in order to thoroughly cover the ground. To assure complete coverage of a block, the rear flank man unwinds a spindle of white twine. This is the guide line for the return strip. Each crewman carries a pick mattock to assist him in removing Ribes bushes.

In this formation the crew proceeds forward as rapidly as working conditions permit. When patches of Ribes are encountered, as is often the case, the crew will not be able to maintain its formation, but all members will work together until the patch has been removed. However, after clearing out a heavy concentration of Ribes, the crew assumes its proper formation at the beginning of the patch and checks it over for missed bushes and pieces of bushes before proceeding to the unworked portion of the strip.

5. Width of strips. Strips should be as wide as working conditions will permit. In country of poor visibility and dense Ribes, the interval between men should be about 12 feet while in open, fairly level country, the interval may be as wide as 60 feet. When men are working in wide formation with very little ground cover present, they should be more concerned in looking for areas where low vegetation is present and for regular Ribes sites than for an occasional bush. Strips should be wider when working up hill than when working down hill. In general it is better to have a strip too wide than one too narrow.

6. Advance string lanes. When areas of medium to dense Ribes concentrations are encountered much time will be saved by letting one man lay out string lines in advance for several crews. Advance string lines should not be laid more than two or three days previous to working as they may be destroyed by cattle, deer, etc. It will be possible for an experienced man to make the lanes as wide as a crew should work in any particular country. Brush type should always be worked by using advance string lanes.

7. Working by eradication types. Each section should be worked by eradication types. Stream type should be worked first. If the type is only one strip wide on each side of the stream, no string lane need be laid but where it is more than one strip wide, string must be used to facilitate the work. The boundary of brush type and cut-over type when not well defined in the field should be marked by running a string line around them.

8. Reworking portion of sections. In reworking an area the original string lines are used when still intact, thus eliminating the need of laying new lanes. Where string lanes have been destroyed, new lanes are run in the same direction as the original ones. One man is used for all work except in brush and special cases where the original string lines have been destroyed, in which case a 2 or 3-man crew may be more effective. Before reworking an area, allow ample time to elapse to insure the wilting of all bushes pulled during the previous working. Ordinarily one man on rework will cover the area worked by four or five regular eradication crews. The acreage covered by one rework man will vary considerably in different areas but should average about 20 acres per day.

9. Determining acreage. The acreage in a crew block should be determined by scaling it off on the map or from pacing figures. This acreage should be given a crew leader with the instructions that his estimated acreage is to equal it when the block is completed.

C. Organization of crews.

Crew members should be studied and analyzed so that crews may be organized on the basis of their speed, efficiency and stamina. Crews with the following types of men may be set up: (1) fast, efficient men, (2) fast, poorer men, (3) slow, efficient men, and (4) slow poorer men. Type No. 1 is to be used exclusively in country of few Ribes; types Nos. 2, 3 and 4 in heavy concentrations with crew No. 3 working most of the brush type. It is assumed that men in all of the crews are physically able, working hard and really trying; otherwise they are to be dismissed. A strong leader should have charge of each crew.

1. Regular crew. The regular crew consists of a crew leader and two crewmen. The crew leader always works in the center with a crewman on each side; one following a string line and the other laying or following another string line, depending upon whether or not advance lanes have been laid.

a. Duties of crew leaders. Each crew is under the direction of a crew leader who is responsible for the speed and efficiency of his crew and for all missed bushes and crowns. He should thoroughly understand that he is responsible for rapid and efficient work on the block to which he is assigned and that reworking a portion of an area of generally heavy Ribes is to be desired and is not a reflection on the quality of his work. He should also understand that reworking areas of few Ribes and brush type is to be avoided. In this case the necessity for rework is a reflection on the quality of his work. He shall report misconduct or negligence of any crewman, such as failure to do the work properly, smoking and general inability. In a notebook provided for the purpose, the crew leader will record the following data for each type worked during the day: (1) all Ribes eradicated by species, (2) hours of work or fractions thereof, and (3) an estimate of acreage covered. At the end of the day he will total his records for the day, tear the sheet out of his book, and turn it over to the camp foreman or straw boss. The crew leader, in addition to his other duties, carries a pick and does the regular work of a crewman.

The proper training of crew leaders regarding crew formation, searching time, speed, laying of string, etc., will do much to eliminate poor and faulty work later in the season.

b. Duties of crewmen. Crewmen must cooperate within the crew to see that it functions smoothly. They carry picks to aid in digging bushes. Each man covers a certain portion of the strip and is responsible for the work done on his part of the strip in addition to following or laying a string line. He must be sure that his Ribes are being dug and disposed of in the proper way.

2. Rework crew. The rework crew usually consists of one dependable man who has proven his speed and efficiency. He follows the string lanes already on the area and should cover 4 or 5 crew days' work in one. At times the straw boss may act in this capacity if it facilitates the work. In brush type or in special cases, a regular crew will probably do the rework.

3. Special crews. Special crews may be needed in working narrow stream type especially in areas being blocked out. Here a one or 2-man crew, which does not lay string, may be used.

D. Factors influencing efficiency.

There are certain factors influencing the efficiency of the work which may be reduced to a minimum by properly training the crewmen and by continuously watching their methods of work.

1. Ribes sites. Ribes are found in practically all sites and under all variations of conditions. However, special emphasis should be placed on the more important Ribes sites as a helpful means of improving eradication efficiency. They are as follow:

(a) Rotten logs and stumps.
(b) Under logs and down timber.
(c) Openings in brush and reproduction.
(d) Outer fringes of brush or reproduction patches.
(e) Depressions and seepages.
(f) Around the roots of windfalls.
(g) At the base of large trees.

2. Use of tools. In order to make the pick mattock most effective, the following precautions must be observed:

a. The ground around large bushes should be loosened with the pick end of the tool before an attempt is made to pull the bush. Place the pick under the crown and pry the bush out being careful to get as many roots as possible.

b. The hoe part of the tool is used to cut and clear out around the bush before digging and to rake the dirt out of the hole after digging but should never be used to dig with as many roots and crowns will

be cut and left which otherwise would have been pulled.

c. Tools should not be thrown at trees or used to chop logs.

d. No man should at any time blaze trees as each blaze in the woods should have a meaning.

e. Tools should be kept sharp and their handles in good condition at all times.

f. In most cases it is quicker to pull or pry bushes out of dense brush than it is to cut the brush away and dig the Ribes. An excessive amount of brush-cutting should be avoided.

g. The men should be held responsible for picks and canteens issued them and should be cautioned against their loss as well as the loss of coats and other property that might be left along the strip.

3. Digging practices. It is imperative that the entire crown of a bush be removed to insure the death of a bush. Any crown tissue left attached to an undug root will sprout. In order to be sure that all of the crown is removed, it is necessary to eradicate, in addition to the crown, at least the first four inches of all roots regardless of size. By observing the following digging practices faster work of a better quality will be obtained.

a. Where possible to do so, it is faster and more thorough to pull bushes than it is to dig them. Bushes may be pulled by hand or pried out by placing the pick end of the eradication tool under the crown. In both cases, use easy, short jerks as vigorous jerking of the bushes usually results in breaking the crown and roots while if care is used they will all come out intact.

b. All bushes should be dug as they are encountered--that is, not the large ones first and then the small ones.

c. Crews should not leave a heavy Ribes concentration without making a final inspection for missed bushes.

d. Since the crew's efficiency is generally low at the beginning and end of a strip and immediately after lunch, a special effort must be made or bushes will be missed at these times.

e. When clumps of Ribes are encountered on a slope, the lower bushes should be dug first to avoid covering up or missing any of the smaller ones.

f. All pulled bushes must be thrown behind the worker on the worked portion of the strip away from any unpulled bushes. Where Ribes grow in concentrations the bushes must be piled so as to leave as much of the area free for inspection as possible; even fragments of live stem should not be left on the ground as in many cases they are attached to roots.

g. Men do more efficient digging while standing; thus kneeling or sitting positions should be eliminated where such are unnecessary.

h. Men should be cautioned against covering unpulled bushes with pulled bushes and debris.

i. Pulled bushes should not be thrown in streams or on wet ground as they will sprout immediately. Following rains all bushes should be hung on brush, trees, etc., so that they will dry out.

j. Before digging a large open-grown R. roezli, all layered tips and young bushes should be dug; and then after the main brush has been dug all the loose dirt should be scraped away so that any missed layered tips or crowns will be exposed.

k. Crewmen should inspect the crowns of pulled bushes and the holes left after digging to determine if any part of the crown or roots remain in the ground.

l. The failure of a man to completely cover his own portion of the strip after he has been assisting a fellow crewman results in missed bushes.

m. Ribes should be pulled by taking a firm hold at the base or crown of the bush and not by pulling at the tips or high on the stems.

n. Only in cases of extremely large bushes, as R. cereum and open-grown R. roezli, should the tops be cut off before digging the crowns, and in these cases cutting is allowed to enable the man to get close enough to work.

VII. Maps and Records

In order to facilitate the work during the summer and to keep a permanent record of eradication work, it is necessary for the camp foreman to make certain maps of his camp area. Maps and records should be both neat and accurate.

A. Maps.

1. Types used on Ribes eradication.

a. Work map of camp area. To help the camp foreman become acquainted with his area, he is supplied with a work map. Reconnaissance data, where available, are plotted; each Ribes plot is indicated in its relative position on the map and the number of Ribes found per acre on each plot is inserted. The Ribes concentration as shown by these plots should aid the camp foreman in laying his plans for work and in determining his final concentration for the base map. The map may have many inaccuracies, but will serve as a basis for building up an accurate, final eradication map.

b. Final eradication map. A final eradication map with a 4" to 1 mile scale is to be made, expanding and correcting the information that

is contained on the work map. It is to be drawn in pencil and built up section by section, first putting on the detail collected by the foreman, and later that obtained by the checkers.

When completed, this map should give quite accurately the following information:

(1) Culture, including the location of roads, trails, streams, buildings, lookouts, springs, fences, water ditches, railroads, old logging grades, main ridges but not spur ridges, tramways, operating or improved mines, saw mills, lakes, meadows, marshes or swamps, section corners, camp location and any other information that may be of value.

(2) Size and shape of sections.

(3) Boundaries and symbols of eradication types.

(4) Boundaries and colors of Ribes concentration classes. At the end of the field season this map is to be inked and turned in to the unit supervisor. A sample map appears in the appendix and should be used as a guide in preparing the final eradication map.

c. Progress maps. Progress maps are necessary to provide current information not only for the camp foreman and his men but also for Blister Rust and Forest Service supervisors who make periodic inspection trips. The two progress maps needed are:

(1) Eradication progress map. The work map furnished to the camp foreman should be used for the eradication progress map. It is to be placed on the bulletin board and the progress of work colored in at the end of each day's work with a green crayon #325. Red string lines that have been run should be shown in red crayon #321½ and corners found are to be shown by a red cross. Type lines and symbols should be shown with red ink. Stream type should be colored red with crayon #321½.

(2) Checking progress map. A rough work map on detail paper will be made by each camp foreman for showing the progress of checking. This map will be colored with a green crayon #325 by quarter sections instead of by each day's work. Areas that must be rechecked will be outlined in red and when rechecked will be cross-hatched with red crayon #321½, the bars running from the lower left corner to the upper right corner. Areas that still do not check out will be delimited with red crayon and when rechecked will be cross-hatched in the opposite direction. Should any area fail to check the third time, it is again delimited in red and when checked the fourth time should be colored solid red.

2. Securing map data. Map data will be taken in the field by both the eradication and checking forces to supplement the information already available.

a. The camp foreman's information. The camp foreman will obtain all information possible from Forest Service maps relating to culture and section surveys. He will verify this information wherever possible,

and in case of errors, will make the necessary corrections.

(1) Culture. While running string lines around or through sections, the camp foreman or straw boss will map the area along his course tying in all streams, roads, etc. that will be of value to him later.

(2) Shape and size of sections. When sections appear different in shape from those shown on the map, they should be checked for error and then reported to the unit supervisor who will also check up on them before they are mapped as final. Several men should check the irregularities before making the final decision and changing a map.

(3) Type boundaries. Eradication type boundaries are determined by the camp foreman and all except stream type should be delimited with string. A right angle traverse is to be used in mapping type boundaries as their location must be quite accurate on the map. (This method will be explained in the training school.) On the map, brush, R. inerme slash and cut-over types, as well as meadows, are separated from timber type by bounding them with a line of red ink and then designating them with the proper symbol. Ordinarily the symbol for timber should not appear but in cases of small areas of timber occurring within other types it is to be used. Eradication type symbols are as follow:

Timber - Tim.
Brush - Br.
Cut Over - CO
Meadow - Md.
R. inerme swamp - IS
Stream - Str.

(4) Ribes concentrations. To aid in future work and management plans, the original Ribes concentration is recorded by classes. As the area is worked, the camp foreman will become familiar enough with his area to know where differences in the Ribes concentrations occur. He is aided and his opinion substantiated by reconnaissance data (where available) and by crew counts. By the time a section is completed, the foreman should have decided what classes and the extent of each that occurred on the section. The boundaries between classes are to be drawn in on the map from the foreman's knowledge of his area and not delimited in the field with string or by other means. The concentration classes are as follow:

Less than 25 ft. of live stem per acre - yellow #353
25 FLS to 50 bushes per acre - sepia #335
51 to 200 bushes per acre - blue #320
201 to 1,000 bushes per acre - green #325
Over 1,000 bushes per acre - violet #323

These classes are to be separated on the map with a dot and dash line of black ink and each class is to be colored in with its corresponding color (see sample map in the appendix).

b. The checker's information. Since a checker crosses a section from 15 to 16 times, his culture is more complete than that taken by the camp foreman and should be used to fill in and to correct and substantiate culture taken by the foreman. Any major discrepancies should be investigated and settled before entering on the map as final.

3. Correlation of maps. When the maps for a forest are completed, they must agree within themselves as well as with each other.

a. Within camp areas. All culture, eradication types and Ribes concentrations must agree within a section as well as between sections for each camp area.

b. On the forest. In making camp maps, the boundary of the camp area must agree with that of the adjacent camp; thus it will be necessary for camp foremen of adjacent areas to get together and jibe their maps. All camp maps must agree within themselves as well as among themselves before a completed map of the work on the forest can be made.

B. Records.

1. Eradication records. Completed samples of all forms appear in the appendix. If any questions arise, consult the sample forms and then the unit supervisor.

a. Hand Eradication Field Record #110. Each camp is provided with a rubber stamp for stamping the headings in a regular Forest Service field notebook. The crew leader records and summarizes each day's work, tears the sheet out and gives it to the camp foreman or straw boss. Data for rework are recorded separately.

b. Daily Eradication Report WF-BRC-#205 . The camp foreman or straw boss will check the figures on form #110 and transfer them to this sheet at the end of each day's work. Rework data are recorded the same as that for original work, but another sheet is used and labeled "Rework".

c. Progress Report WF-BRC-#200 . This sheet is divided into three identical forms and is to be cut apart as used. It is to be turned in to the unit supervisor at the end of each week or month as the case may be. Data for this form will be taken from the Daily Eradication Report.

2. Time records.

a. Time Report, F.S.#874-15. Time slips are to be made out for every man in camp and these must be accurate. These will be turned in to the unit supervisor the last day of each month.

b. Time book. The time book is kept in addition to time slips and is the camp record of the hours worked and meals taken. It must check with the time report turned in to the unit supervisor. Meals chargeable to fire time are entered in red.

c. Daily Man-Day Analysis Sheet WF-BRC-# . Entries are to be made at the end of each day's work and must check with the total number of men working in camp. The item "travel time" is that time for which men may be paid while traveling to camp at the beginning of the season. This form is to be kept in duplicate and the original turned in at the end of the month to the unit supervisor. Be sure that the total man days on this form checks with the payroll. Symbols will have to be used for the straw-bosses' time.

3. Truck records.

a. Equipment Operation Cost, F.S. #469a. One of these books is to be kept in each truck, and when gasoline, oil, etc. are obtained, an entry must be made in the book. Labor and repairs are also recorded. Where actual prices are not available, get an estimate from the unit supervisor.

b. Daily Truck Report WF-BRC-# 118 . Data from the equipment operation cost book are transferred onto this form and turned in at the end of each month. This form applies only to those trucks and pickups which belong to the Bureau of Entomology and Plant Quarantine.

c. Report on Motor Vehicles WF-BRC-# . This form is to be filled out each time a truck is transferred between camps and again at the end of the season.

4. Miscellaneous records.

a. Requisition for Supplies WF-BRC-# . All food and supplies must be ordered on this form and signed by the camp foreman. The cook can make out the order but the camp foreman must look it over and sign it.

b. Application and Personnel Record WF-BRC-# 12A. The first part of this form will be filled out by the employee as soon as he reports while the latter part will be filled out by the camp foreman after the employee leaves camp. These must be completed for every man in camp.

c. Inventory of Camp Equipment WF-BRC-# . This form must be filled out and checked in detail. It will have the number of each item charged to a camp but the camp foreman must check his equipment to see if it is complete. He must also check the equipment at the end of the season and turn in this form to the unit supervisor.

APPENDICES

APPENDIX A.

REGULATIONS TO BE FOLLOWED IN THE MANAGEMENT OF THE KITCHEN AND MESS HALL

These regulations are issued to help clarify the duties and responsibilities of the kitchen staff so that the kitchen and mess may be conducted as economically and as efficiently as possible.

The first cook will be in charge of the kitchen and mess hall and will direct the efforts of the kitchen staff and will be responsible to the camp foreman for the manner in which the kitchen is conducted and for the results accomplished. The first cook must thoroughly understand what is expected of him and then allot certain duties to his helpers so that they can work on a definite routine.

The cook and his staff are responsible for the following:

1. Preparation of meals. The cook must prepare menus for all meals and should be guided by the likes and dislikes of the men in so far as this does not interfere with the economical preparation of meals.

Meals are to be served promptly on the hour set by the camp foreman.

Meals should be well balanced so that a proper diet is afforded the men.

Food left after a meal should be used if possible for subsequent meals.

Clean, wholesome food is to be served at all times.

Lunch material will be prepared and placed on the lunch table and each man will put up his own lunch. The bread and meat should be sliced, jam and other lunch spreads should be opened, the butter should be softened or melted, and everything necessary for a lunch should be on the table early enough so that some of the men can make their lunches before breakfast. One piece of fruit such as an orange or apple is to be available to each man and a certain amount of dessert such as one piece of cake or two cookies, etc. should be available to each man. Sandwiches are to make up the rest of the lunch. The kitchen staff must see that meats, fruits and desserts are properly apportioned and any man failing to adhere to his share of lunch items is to be reported to the camp foreman.

2. Sanitation of kitchen. The mess and kitchen tables, meat safe, sinks and floors must be scrubbed as often as necessary to keep them clean. In camps that do not have a floored mess hall the dust must be sprinkled down daily.

The mess gear must be washed in soap suds and thoroughly rinsed in boiling water after each meal.

The garbage cans must be kept fly-proof and the garbage disposed of daily.

Disinfectants are to be used frequently in garbage, dump and latrine pits.

Use fly spray as often as needed to keep flies under control in the kitchen and meat safe.

Do not let spoiled fruit and vegetables or empty boxes remain in the supply tent. The ripest fruit and vegetables should be used first so as to reduce the loss from this source to a minimum.

Waste water must not be thrown near the kitchen but must be run through the drain or carried to the garbage pit.

All members of the cooking staff must keep neat and clean at all times.

3. Orderliness of kitchen. There should be a place for each article in the kitchen and supply tent and each should be in its proper place when not in use.

Wood and box refuse must be piled and not left lying around.

When supplies arrive, they must be immediately checked and stored in the supply tent.

The living quarters of the kitchen staff must be kept as orderly as the kitchen.

4. Ordering food supplies. The cook is responsible for filling out the form "Requisition for Supplies". He must order enough food each time to do him until the next supply arrives as it is difficult to supplement an order once it has been turned over to the warehouseman. The cook should be as careful about getting too much food on hand as he is about having enough on hand. Since each camp receives supplies at regular and frequent intervals, a large stock should not be carried. This is especially true near the end of the season. The camp foreman must approve and sign all supply requisitions. The cook should confine his order to the items listed on the bid.

5. Custodian of supplies. The cook will be held responsible for all food checked in to him by the truck driver. If food is missing from either the cook house or supply tent, report it immediately to the camp foreman.

REGULATIONS ON SANITATION TO BE POSTED IN KITCHEN

1. The mess and kitchen tables, meat safe, sink and floors must be scrubbed as often as necessary to keep them clean. In camps that do not have a floored mess hall, the dust must be sprinkled down daily.

2. The mess gear must be washed in soap suds and thoroughly rinsed in boiling water after each meal.

3. The garbage cans must be kept fly-proof and the garbage disposed of daily.

4. Disinfectants are to be used frequently in garbage, sump and latrine pits.

5. Use fly spray as often as needed to keep flies under control in the kitchen and meat safe.

6. Do not let spoiled fruit and vegetables or empty boxes remain in the supply tent. The ripest fruit and vegetables should be used first so as to reduce the loss from this source to a minimum.

7. Waste water must not be thrown near the kitchen but must be run through the drain or carried to the garbage pit.

8. All members of the cooking staff must keep neat and clean at all times.

SUGGESTED CAMP REGULATIONS

1. Meals will be served at the following hours:

Meal	Work Days	Other Days
Breakfast	6:20 a.m.	8:00 a.m.
Dinner	In field	1:00 p.m.
Supper	5:30 p.m.	5:30 p.m.

A gong will be sounded in the mornings 20 minutes before breakfast and 5 minutes before the other meals. Everyone is expected to be on time for each meal.

2. No smoking is permitted out of camp and precaution should be taken against fire while smoking in camp. This is a state and Federal law.

3. Absolutely no drinking or liquor will be allowed in camp. Men must be in fit condition to perform a day's work on Mondays.

4. No gambling will be permitted in camp.

5. No fire arms are to be discharged in or near camp.

6. Latrines must be used while in camp.

7. Keep out of the kitchen.

8. Do not pollute any water sources.

9. Vulgar talk must be kept within bounds while at the table.

10. Tents and camp area must be clean and orderly at all times.

11. No unnecessary noise will be tolerated after 9:30 p.m.

12. Tools must be replaced in tool rack after use.

13. Men leaving camp must notify the foreman prior to departure.

14. Men intending to miss meals must notify the cook in advance. All men will be charged with meals prepared for them whether taken or not.

15. Lunch papers and other refuse must be buried and not strewn around the woods.

16. No dogs allowed to stay in camp.

17. All National Forest regulations must be obeyed.

18. Your cooperation in carrying out the above regulations is expected at all times.

_____Camp Foreman.

Note: These are suggestions--do not tear out of manual and post.

APPENDIX B

INFORMATION ON PACING, COMPASS WORK AND PUBLIC LAND SURVEYS

I. Pacing

Pacing is the method of measuring distance by counting steps of a known length. It is usually employed to measure horizontal distances and while it is not as accurate as instruments, a man with practice can obtain a degree of accuracy that is suitable for rough work.

A. Procedure.

Although a pace is defined as one step, in general practice it is considered as two steps (a stride) or the distance between the heel of one foot and the heel of the same foot when it next touches the ground. Since the length of pace varies with individuals, the best way for a man to ascertain the length of his pace is to measure off on level ground a course of several chains and to pace this distance enough times to determine the number of paces per chain. A man should walk naturally while determining his pace as this results in each pace being more nearly the same length. To be able to pace under adverse conditions with the required degree of accuracy, it will be necessary to pace over measured courses running up and down slopes of different degrees and through brush to determine the allowance necessary under these conditions. Definitely known distances between points such as section corners offer a good opportunity to check pacing. The individual may find it necessary to increase or decrease the number of paces per chain during the summer.

B. Instruments used.

A box compass is ordinarily used to determine courses for pacing; it is as accurate as the pacing method of measuring distances requires. A description and discussion of the box compass appear later.

A tally register is frequently used to count paces and is usually carried in the left hand with the thumb working the lever each time the left foot touches the ground. The tally register should be checked every few chains to see if it is functioning properly as it is occasionally a source of error. Turn the register back to zero each time a new strip or line is being started to prevent error from this source. If it becomes clogged, wash it in kerosene and add a few drops of oil.

C. Factors influencing the accuracy of pacing.

There are several factors influencing the accuracy of pacing but with care these can be sufficiently overcome to obtain the desired results. They are as follow:

1. Topography. Land surveys are based on horizontal distances, consequently allowances at all times must be made in pacing for various degrees of slope. The number of paces per chain will have to be increased when traveling up or down slopes. Occasionally in rough country and in dense brush it is more accurate to estimate short distances than it is to

pace them. Where difficulties are encountered it is always more accurate to increase the number of paces per chain or estimate the number of paces for short distances than it is to try to maintain the same length of pace that is taken on level ground.

2. Ground cover. Dense reproduction, brush or bear clover, or a combination of these make accurate pacing more difficult. This is especially true when they are encountered on a steep slope and additional care must be taken under these conditions.

3. Condition of soil. Loose, rocky, or swampy soils are more difficult to pace on than a firm, dry soil.

4. Rain and wind increase the difficulties of obtaining accuracy.

5. Human factors. A man's vitality may decrease after a hard day's work, a poor night's sleep, or with physical illness and as a result he is apt to under-pace. On the other hand, in the morning, immediately after leaving difficult country, or when he is in a hurry, he is apt to lengthen his stride and over-pace. A man's pace is shorter when he is traveling slowly than when moving at his natural rate. Whenever a man leaves the compass line during his work, a mark in the duff, a pile of stones, or a stake should be left to indicate the point; otherwise the work must be redone or an error is likely to occur.

II. The Box Compass

A. Description of the compass.

The essential parts of the box compass are a magnetic needle for finding a meridian line, a horizontal, graduated circle for laying off angles from this meridian and sights attached for use in prolonging lines on the ground. On circles graduated from 0° to 90° the 0° points are marked N and S and the 90° points are lettered E and W. Some compasses are graduated from 0° to 360° in which case the E point is 90°, S is 180° and W is 270°. Usually the north end of the needle is marked with an arrow and the south end is weighted with a wrapping of wire. The direction which the north end of the needle assumes is called the magnetic north. Since the needle always points to magnetic north and the box turns under it, the letters E and W on the box are reversed from their natural positions so that the reading of the north end of the needle will give not only the angle but also the proper quadrant. The angle between the magnetic north and true (geographic) north is called the declination of the needles. In California the declination varies from about 17° to 20° east of the true north according to the locality.

B. How to use the compass.

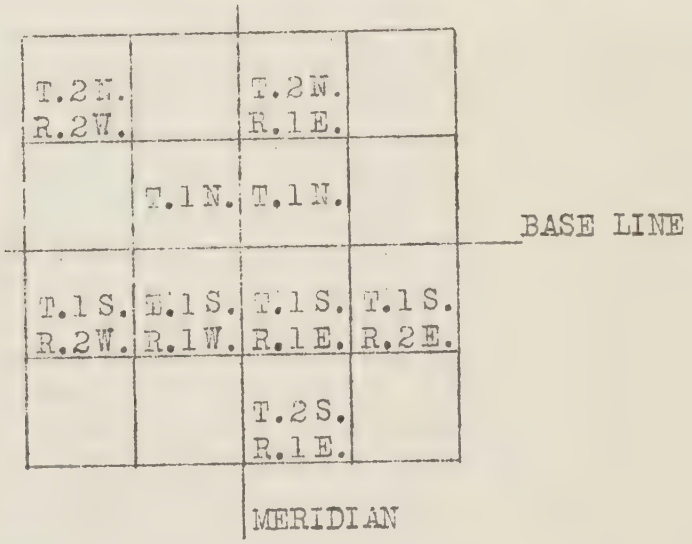
Before using the compass, the graduated circle must be shifted to the right (clockwise) until the declination reading coincides with the white line along the lid of the compass. Then when the needle points to 0°, the line of sight on the lid of the compass points to true north. Likewise when the needle points to E 90°, even though the letter is on the left side of

the compass and pointing north, the line of sight is true east.

In taking a sight, the compass should be level, with the lid pointing away from the person's body until the north end of the needle comes to rest at the desired bearing. Then sight along the white line on the lid of the compass which is always the line of sight to be followed, and proceed in that direction. If the needle does not swing freely or is caught, the small lug in the upper left corner will release it. Metallic articles that will attract the needle must be kept away from the compass or a false reading may be obtained. A moist finger touched to the glass of the compass will release any magnetism that might be affecting the needle. When the course has been determined, pick out an object along the line of sight as a guide and proceed to it, then take another sight, etc. For best results, the elbows should be held firmly against the body and the compass held in both hands. Before moving after taking a sight, the compass should be closed because this not only avoids injury to the needle and pivot but also saves time when the next shot is taken as this always leaves the needle pointing to the bearing of the line being followed. Time will be saved and certain errors avoided if the north end of the needle is always read.

C. Public land surveys.

Most lands in the United States have been surveyed under the rectangular system of public land surveys. The land is divided into townships which are usually six miles square. The townships are located north and south of a base line and east and west of a meridian by range. For example: township 1 north, range 2 east. The system of numbering is as shown below:

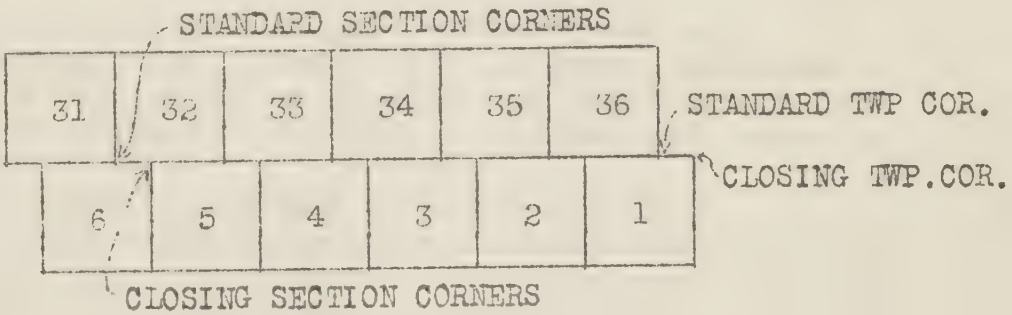


The township is divided into 36 sections which are usually one mile square. They are numbered as below:

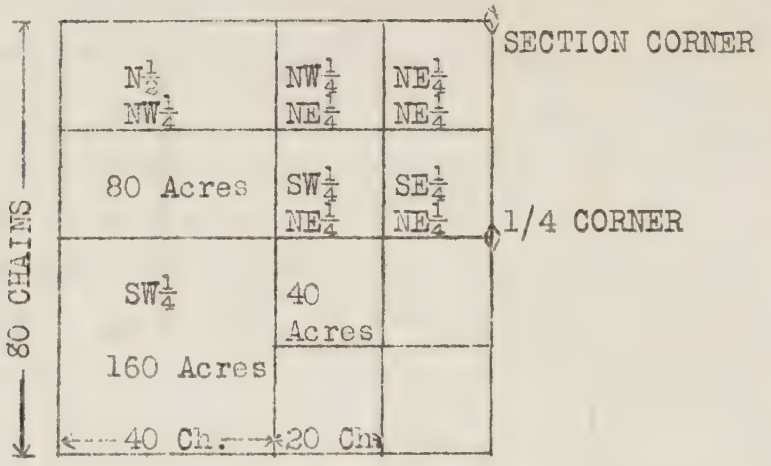
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

A section usually contains 640 acres and is 80 chains on a side but may often be irregular in shape and more or less than 80 chains square. Section lines are usually run in true cardinal directions, but may be several degrees off from the true line.

Corrections for cumulative differences and errors in the lengths of section lines are made along township lines, hence frequently section corners which should be common to the sections in two adjacent townships will not coincide. When this is the case, corners will be found for the sections in each township. These corners should all be shown on the map. The diagram below illustrates this point.



The section has the following subdivisions:



The maps of the area will usually show any inequalities in the township and sections.

Section lines and corners are the two most important landmarks to be found in the woods. Most of the boundaries used in blister-rust work are section lines.

Line trees are those directly on the section line; they are blazed on opposite sides, either with one or with three blazes one above the other, the blazes facing forward and backward along the line. Trees near the line are scored with two blazes (or two sets of three) quartering toward the line, and the farther the trees are from the line the nearer together the blazes are placed and vice versa. These blazed trees are of great use in marking and finding the position of a line through timber. Sometimes blazed lines are found in the woods which are not section lines; here care is essential or they are apt to cause a great deal of trouble. Scars due to fire or injury should not be confused with line blazes. Tally stakes may sometimes be found along the line. A tally is five chains.

An X or cruiser's tag on a tree along a trail or road designates a section-line crossing. The township, range and section are marked on the tag, together with the distance to the nearest corner (usually) and a tack gives the location of the marker in a diagrammatic section.

Section and quarter corners in mature timber are designated either by a stake or a pile of stones and witness trees. The corner stake when present is scribed with the township and range and the sections to which it is common. Section corners usually have four witness trees--one in each section. These are marked with a blaze about 6" to 8" wide and 12" to 16" high about a foot above the ground. The blaze faces the section corner and is scribed with the township, range and the section in which the tree is found and is marked "B.T." (bearing tree). The old witness blazes are usually grown over forming a scar about 18" long. The witness trees are sometimes tagged with cruiser's tags and "attention" signs. Many cruisers have marks (monograms) of their own that they cut in the bark of a tree near the corner. These marks often aid in locating a corner.

The quarter corner stake is usually scribed with the fraction 1/4 S. There are generally two witness trees, one for each section, which are blazed in the same manner as those for section corners and are usually scribed with 1/4 S above the letters B.T.

Do not blaze trees in the woods, particularly in the vicinity of section corners and section lines. Meaningless blazes too often obscure true survey marks and make their recognition and location difficult. Blazes in the woods should have a definite meaning.

Regular Forest Service trails are blazed with an inverted exclamation mark.

When searching for section corners, look for blazes, stakes, tags, cruisers' monograms and piles of rock. Do not give up too easily; search the ground thoroughly and systematically for at least seven chains in all directions from where the corner should be, since the pacing or alignment or both may be off. In logged areas most of the blazed trees have been cut, and even the corner and witness trees are occasionally destroyed. If this is the case, search the stumps for bearing tree blazes.

Corners, witness trees, section lines, etc. are usually found as described above but many variations occur.

I. WHITE PINE BLISTER RUST - LIFE CYCLE AND HISTORY

White Pine Blister Rust, the fungous disease which threatens destruction to the western white pine of the Inland Empire and the sugar pine of California and southern Oregon, can be controlled. The hope for effective control of this disease lies in the fact that a secondary host plant is necessary to complete the life-cycle of the fungus which causes the disease. The rust cannot spread from pine to pine; it must go through a stage of development on intermediate host plants, currant or gooseberry bushes, commonly known in control work as Ribes. While this disease can spread long distances from pine to Ribes, the spread from Ribes to pine can take place over relatively short distances up to only a few hundred feet. The fact that it is impossible for infection to spread from pine to pine, coupled with the short distance spread from Ribes to pine makes possible the control of this disease by the eradication of Ribes from within and around any stand of pine which warrants protection.

Blister Rust is slow but sure in action. While it may take twenty or thirty years to kill mature pine, the younger stands will be wiped out in a few years unless control measures are applied. The rust first appears on pines as a yellowish discoloration of the bark accompanied by a slight swelling. The canker continues to develop and spread until the trunk or branch is killed by girdling. Some branch cankers will spread to the bole and kill the tree. While this is taking place, the cankers are scattering Ribes-infection spores to the four winds through a fruiting process. Each spring small whitish sacs containing a reddish rust push their way through the diseased area of the bark and burst open, liberating millions of spores. These spores have relatively thick walls, live for a long time and can infect Ribes up to distances of more than 200 miles.

The rust appears on the under-surface of the Ribes leaf as orange-colored spots or pustules. This spring and early summer stage produces spores which can spread from leaf to leaf or locally from bush to bush. Later in the summer small hair-like columns grow from the diseased area of the leaf. These hair-like structures produce the only type of spore which can infect the pine. These spores have extremely thin walls and live for only a few minutes which explains the short distance spread from Ribes to pine. The disease enters the pine through the needles and grows in the inner bark becoming visible from 1 to 3 years after infection.

Blister rust has an interesting history. Commonly believed to have originated on Pinus cembra in Siberia, it was first discovered in the Baltic provinces of Russia in 1854 on both Ribes and pine. During the three decades following 1860, it spread generally over the range of pine in western Europe where during the middle of the 19th century the white pine of eastern America was used extensively in reforesting. Damage from blister rust has been so severe that the use of white pines in reforesting and the growing of white pines for profit have been largely given up.

While blister rust was taking such a heavy toll in Europe, the planting of white pine in the Eastern United States and Canada had increased so

rapidly that our nurseries could not supply the demand. During the last few years of the last century and early in the present century white pine was imported from Europe. Through this importation of nursery stock blister rust gained a foothold in eastern America about 1898. As the disease does not become visible until some time after infection, it is probable that the rust could not be detected when these imported trees were planted. It was discovered in the state of New York in 1906 on the cultivated black currant and in New England on native pines in 1915 and 1916. It has spread generally over the Northeastern states, southward as far as Virginia and westward into the Lake states region where it was located in 1916.

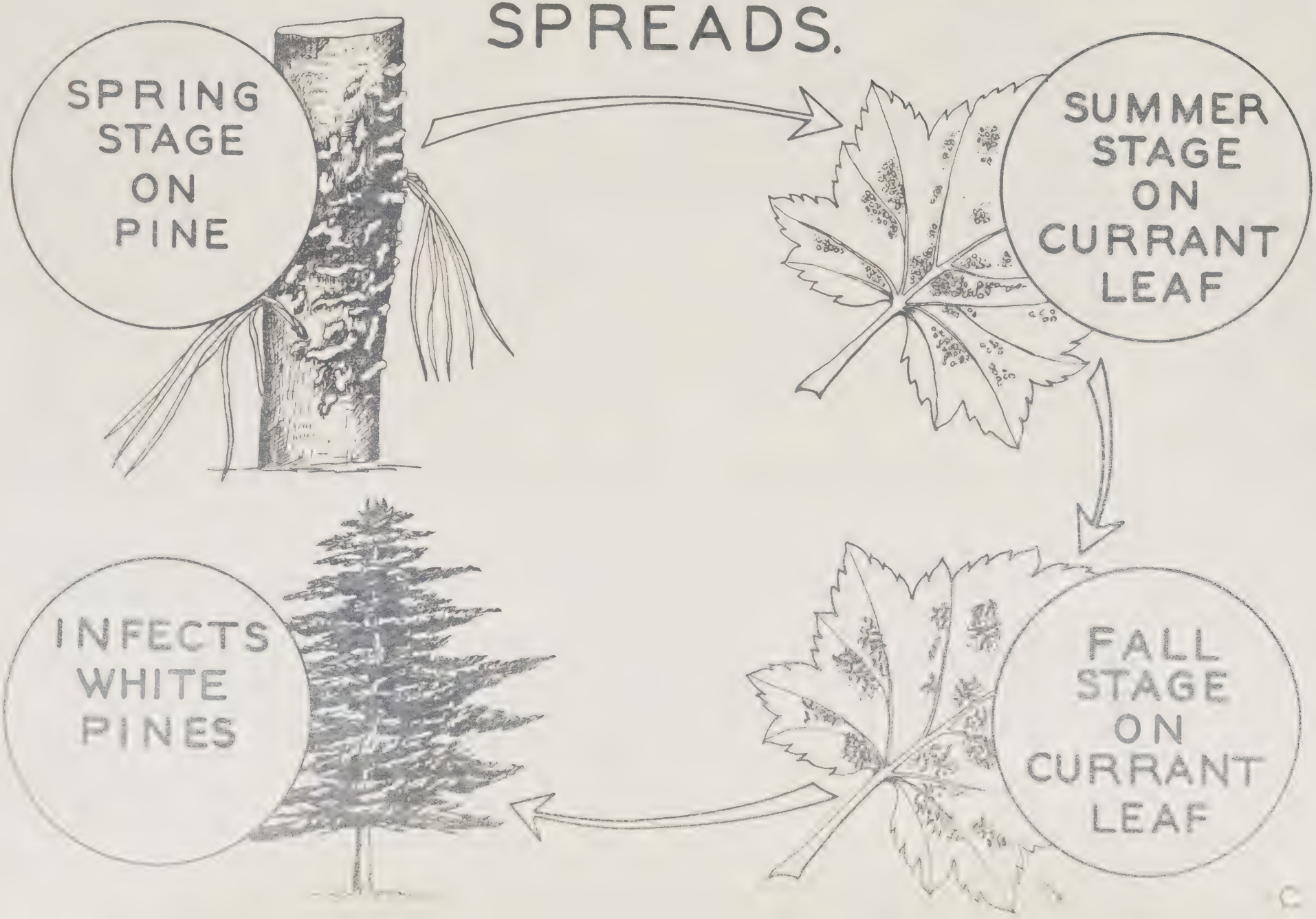
The spread of blister rust to the West from eastern infection centers was prevented by the strict enforcement of quarantine laws which prohibited the shipment of host plants to points west of the Mississippi. The rust became established in the West however in the same way as in the East, by the importation of European nursery stock. Discovered at Vancouver, B. C. in 1921 the rust was traced to a shipment of pines from France to Vancouver in 1910. Since its introduction blister rust has spread eastward through the interior of British Columbia to the Inland Empire and southward through the coastal region of Washington and Oregon almost to California.

While the rust became established in the Inland Empire in 1923 it was first located in 1927 on Ribes near the Falls Ranger Station on the Kaniksu National Forest, Idaho and in the spring of 1928 on pines at Newman Lake, Washington. Since that time 128 additional centers of pine infection have been found in the white pine forests of North Idaho, 15 of which originated in 1923. Ribes infection may be found each year generally distributed over the white pine belt of the Inland Empire.

The most southerly known pine infection center in the West was located in Oregon in 1934 on Steamboat Creek in the upper drainage of the North Umpqua River in Douglas County, approximately 100 miles from California. Infection on Ribes has been found on the Oregon coast less than 50 miles from the California line. Blister rust is not located usually for some time after its introduction to a region and while extensive scouting in northern California has thus far failed to reveal the presence of the rust, it is entirely possible that it has already become established in the sugar pine stands of northern California.

While control of this disease has not been attempted seriously in Europe, practical and effective control measures have been instituted in the eastern United States and are being developed in the Lake States. In the West conditions are entirely different to those in the East and the pine is more susceptible to blister rust. Several years experimentation and development have resulted in practical control methods, proper application of which with adequate follow-up maintenance work will result in protecting our valuable stands of white pine and will reduce a virulent type of forest disease to the status of a minor pest.

HOW BLISTER RUST SPREADS.



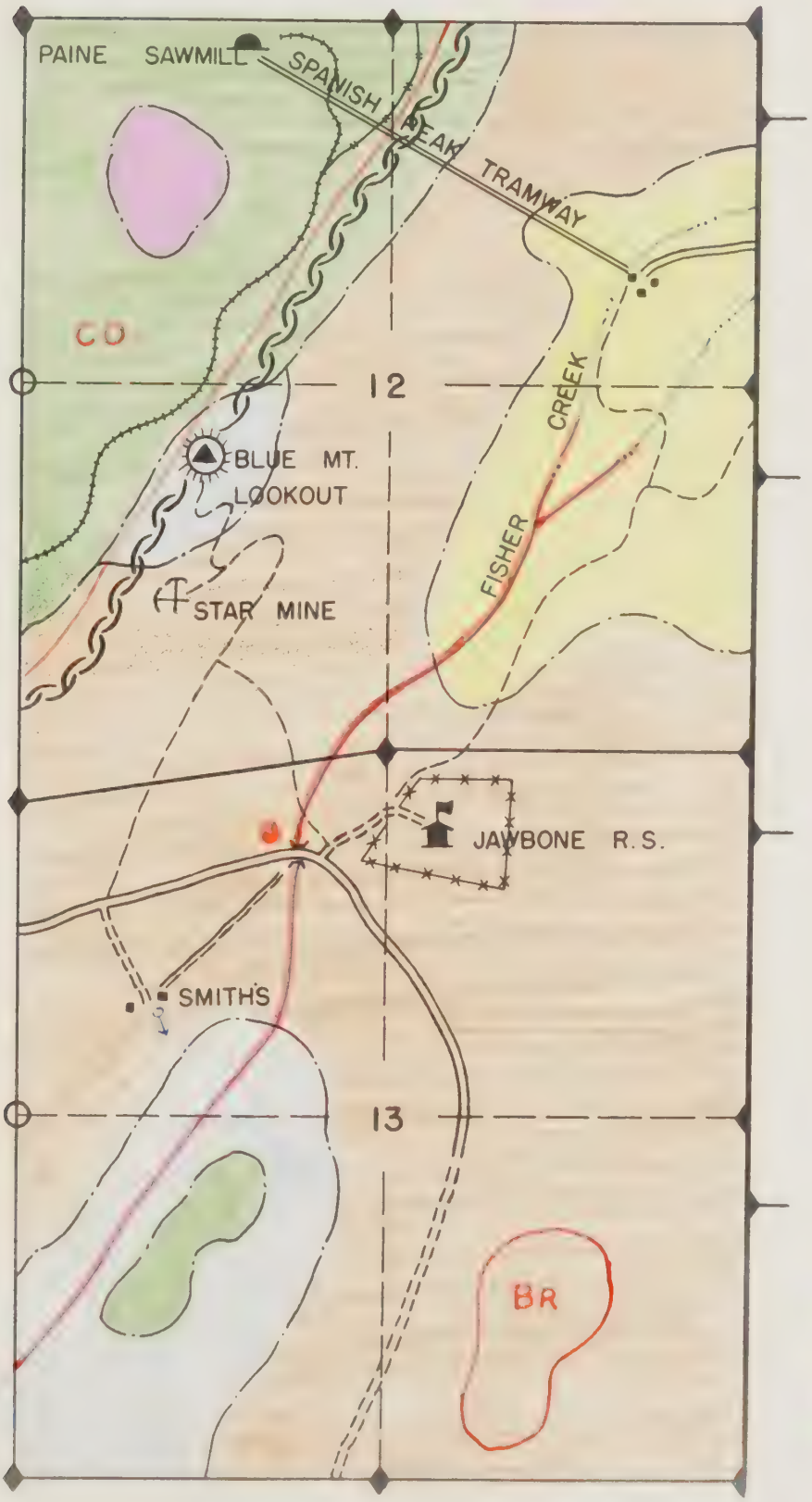
FINAL ERADICATION MAP

CAMP 5 PLUMAS NATIONAL FOREST

20Chs 10Chs 0 20Chs 40Chs 60Chs

SCALE

1935



LEGEND

- Ranger Station
- Buildings
- Main Ridges
- Saw mill
- Primary lookout
- Primary road
- Secondary road
- Trail
- Ditch
- Fence
- Railroad
- Abandoned railroad
- Mine
- Tramway
- Spring
- Running stream
- Intermittent stream
- Meadow
- Marsh or swamp
- Camp location
- Found section corner
- Unfound section corner
- Bridge

SYMBOLS

- Type line
- CO Cut-over type
- BR Brush type
- Stream type
- TIM Timber type
- IS Ribes inerme slash
- Concentration line
- Less than 25 F.L.S.
- 25 F.L.S. to 50 bushes
- 51 to 200 bushes
- 201 to 1,000 bushes
- Over 1,000 bushes

WF-BRC-#97-4/1/34

WEEKLY PROGRESS REPORT

National Forest _____ Month _____ Year _____

Camp	Timber			Stream			Cut-Over			Brush			Total		
	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes
Total															

WF-BRC-# 200 4/19/35

PROGRESS REPORT

Camp No._____ Month or Week of_____ _____

Class	Timber			Stream			Cut Over			Brush			Totals		
	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes
Worked															
B.O.															
Total															

Remarks:_____

_____

Camp Foreman_____

PROGRESS REPORT

Camp No._____ Month or Week of_____

Class	Timber			Stream			Cut Over			Brush			Totals		
	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes
Worked															
B.O.															
Total															

Remarks:_____

_____

Camp Foreman_____

PROGRESS REPORT

Camp No._____ Month or Week of_____

Class	Timber			Stream			Cut Over			Brush			Totals		
	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes
Worked															
B.O.															
Total															

Remarks:_____

_____

Camp Foreman_____

WF-BRC-# 201 4/19/35

DAILY MAN-DAY ANALYSIS SHEET

Forest_____ Camp No.___ Montn_____ Year____

Class	Item	Man Days for Camp																													Total	Total Net Sal.
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
Supervision	Camp Foreman																																	
	Straw Boss																																	
	Total																																	
Kitchen Help	First Cook																																	
	Second Cook																																	
	Flunky																																	
	Total																																	
Labor	Eradication																																	
	Camp Constr.																																	
	Road and Trail Constr.																																	
	Camp Detail																																	
	Travel (pd. time)																																	
	Truck Driving																																	
	Packing																																	
	Breaking Camp																																	
	Total																																	
Grand Totals																																		

WF-BRC-# 202 4/19/35

MONTHLY MAN-DAY ANALYSIS BY CAMPS

Forest _____ Month _____ Year ____

Class	Item	Man Days by Camp and Forest																				Tot.Net Salaries
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		Gen.	Total	
Supervision	Camp Foreman																						
	Straw Boss																						
	Total																						
Kitchen Help	First Cook																						
	Second Cook																						
	Flunky																						
	Total																						
Labor	Eradication																						
	Camp Construntion																						
	Road and Trail Construction																						
	Camp Detail																						
	Travel (pd. time)																						
	Truck Driving																						
	Packing																						
	Breaking Camp																						
	Total																						
Clerical Help	Office Clerk																						
	Field Clerk																						
	Total																						
Employed on Transportation	Truck Driving																						
	Packing																						
	Mechanic																						
	Warehouseman																						
	Whse. Assistant																						
	Total																						
Miscellaneous	Blacksmith																						
	Carpenter																						
	Total																						
Grand Totals																							

FS-203-4/19/35

EQUIPMENT OPERATION COST

Make_____ F.S.Unit No._____

FIELD RECORD

Engine No._____ Month_____ 193____

Date	Hours	Miles	Gasoline		Oil & Grease		Tires and Tubes	Storage	Accessories	Repairs			Miscellaneous	Idle Hours (Breakdowns)		Remarks, Activity, etc.
			No. Gals.	Cost	No. Qts.	Cost				Cash Parts	Cash Labor	F.O. Time		Waiting Parts	Repair	
Total																

WF-BRC-# 204-4/19/35

PRODUCTION FORM

Camp No._____

Date	Daily					To Date				
	M-Days	Acres	Ribes	Acres/ M-Day	Ribes/ M-Day	M-Days	Acres	Ribes	Acres/ M-Day	Ribes/ M-Day
Total										

WF-BRC-# 205-4/19/35

DAILY ERADICATION REPORT

Sec.____ Twp.____ Rg.____ Camp____ Unit____ Forest____ Year____ Foreman____ Camp

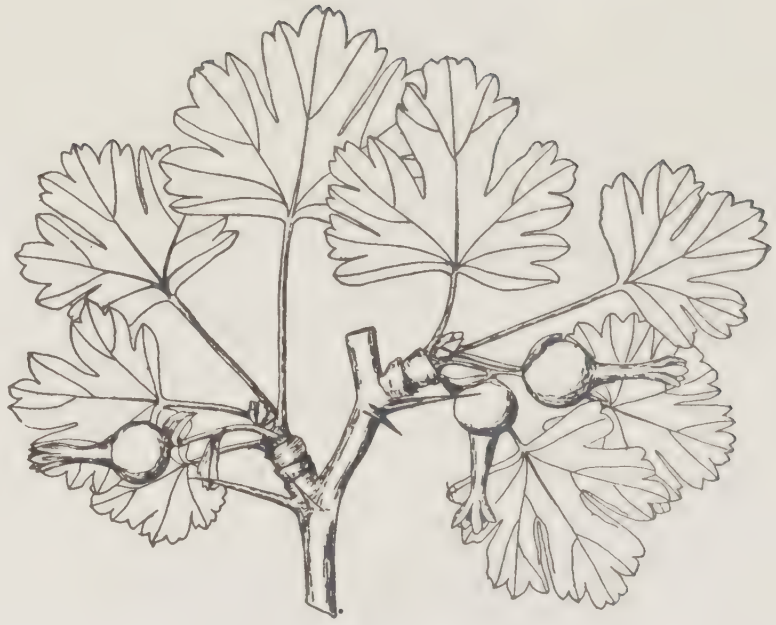
Date	Timber			Stream			Cut Over			Brush			Totals		
	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes	M-Days	Acres	Ribes
Worked															
P.O.															
Total															

Date	R. roez.	R. nev.		Total	R. roez.	R. nev.		Total	R roez.	R. nev.		To- tal	R. roez.	R. nev.		To- tal	R. roez.	R nev.		Total
Total																				

(1-1/3 Nat. size)

Ribes inerme (white-stemmed gooseberry)

1. Leaves - smooth, 5-lobed, deeply cleft, 1 to 3" broad, margins thin and large-toothed.
2. Stems - slender, usually erect, bark whitish, 1 to 3 short spines at nodes or wanting, spines softer and fewer than those on R. roezli.
3. Flowers - greenish or purplish, 1 to 3 in cluster.
4. Fruit - smooth, shiny, round, black or deep purplish.
5. Habitat - 3,000 to 8,000; swamps or bordering sluggish streams usually intermingled with willows, alders or other vegetation.



(2 X Nat. size)

Ribes lasianthum (gooseberry)

1. Leaves - generally hairy on both surfaces, deeply 3 to 5-lobed, roundish, 1/2 to 3/4" broad.
2. Stems - rigidly and intricately branched, bark white and shreddy; 1 to 3 slender spines at nodes; rarely with prickles.
3. Flowers - clusters 1 to 3-flowered (rarely 3 or 4), yellowish, hairy and cylindrical.
4. Fruit - reddish or crimson berry--without hair or glands, round and small.
5. Habitat - open, dry sites only rarely found in the higher altitudinal range of sugar pine.

Compiled by
W.W. Spinney - Oakland 3/38

(Nat. size)

Ribes roezli (prickly-fruited gooseberry)

1. Leaves - smooth to densely hairy on both surfaces, 3-5 cleft into toothed lobes, seldom more than 1" wide, generally less.
2. Stems - stout and smooth, erect from ground tending to spread and droop. 1-3 spines at nodes.
3. Flowers - deep red or purplish, one or two in cluster, long, tubular.
4. Fruit - yellow or purple to deep red, spined berry, pleasant to taste, only spiny fruited gooseberry in S.P. type of Sierra Nevadas.
5. Habitat - generally distributed on all slopes and sites 3,000 to 7,000 ft.

(Nat. size)

Ribes nevadense (Sierra Nevada currant)

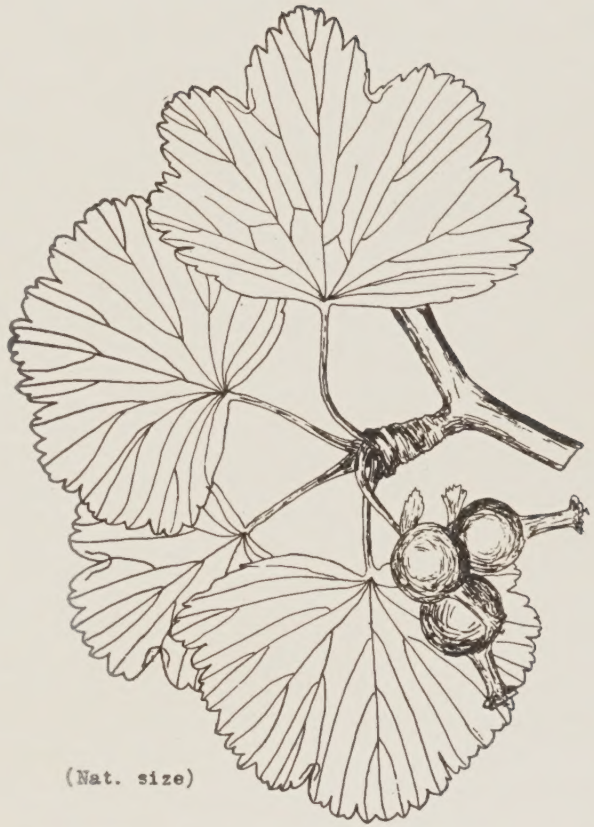
1. Leaves - smooth above and nearly or quite so below. 3 to 5 lobes slightly cleft, margins fine-toothed, 1½ to 3" broad, reclining.
2. Stems - slender and erect, smooth, no spines.
3. Flowers - rose color to red in many-flowered clusters.
4. Fruit - black with bloom, smooth, round, sharp musty taste.
5. Habitat - 3,000 to 7,000; abundant along streams and on wet sites.

Compiled by
W. W. Spinney. Oakland 9/35

(½ Nat. size)

Ribes viscosissimum (Sticky currant)

1. Leaves - thick, hairy and sticky, noticeable spicy or peppery odor when crushed, (shallowly, 3-lobed, rounded) 1½ to 3" broad, deep-veined, giving a crinkly effect.
2. Stems - smooth, erect but spreading, reddish, shreddy bark, no spines.
3. Flowers - light green, sometimes tinted with purple--3 to 13 flowered, erect clusters.
4. Fruit - black, sticky, oblong, noticeably ribbed, sticky hairs present.
5. Habitat - high altitude, under timber, all sites 4,500 to 5,500.



(Nat. size)

Ribes cereum (squaw currant)

1. Leaves - smooth, heavy odor but not so pronounced as R. viscosissimum; slightly sticky, wide, 3 or 5-lobed shallowly cleft. 1/2 to 1½" broad.
2. Stems - stiff, much-branched, smooth, no spines--always erect, but spreading.
3. Flowers - white or pinkish--clusters 2 to 9-flowered and drooping.
4. Fruit - red, round, smooth and slightly sticky.
5. Habitat - all high sites, 5,000 to 12,000 ft. in fir types.

Compiled by
W.W. Spinney - Oakland 8/25